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09/787,502	03/16/2001	Kazuyuki Tadatomo	210013	3944

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EXAMINER
ORTIZ, EDGARDO

ART UNIT	PAPER NUMBER
2815	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.	Applicant(s)
09/787,502	Tadatomo Et.al.
Examiner	**Art Unit**
Edgardo Ortiz	2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) [X] Responsive to communication(s) filed on *Oct 10, 2002* .

2a) [X] This action is **FINAL**. 2b) [ ] This action is non-final.

3) [ ] Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) [X] Claim(s) *2-12* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) [ ] Claim(s) _____ is/are allowed.

6) [X] Claim(s) *2-12* is/are rejected.

7) [ ] Claim(s) _____ is/are objected to.

8) [ ] Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) [ ] The specification is objected to by the Examiner.

10) [ ] The drawing(s) filed on _____ is/are a) [ ] accepted or b) [ ] objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) [ ] The proposed drawing correction filed on _____ is: a) [ ] approved b) [ ] disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) [ ] The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) [ ] Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) [ ] All b) [ ] Some* c) [ ] None of:

1. [ ] Certified copies of the priority documents have been received.
2. [ ] Certified copies of the priority documents have been received in Application No. _____ .
3. [ ] Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) [ ] Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) [ ] The translation of the foreign language provisional application has been received.

15) [ ] Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) [X] Notice of References Cited (PTO-892)
2) [ ] Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) [ ] Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
4) [ ] Interview Summary (PTO-413) Paper No(s). _____
5) [ ] Notice of Informal Patent Application (PTO-152)
6) [ ] Other:

DETAILED ACTION

This Office Action is in response to an amendment filed October 10, 2002 on which Applicant amended claims 2, 6 and 8.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 2, and its dependent claims, are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 2 contains the limitation "in which a light enters a depletion layer formed under the electrode, which extends to cover a small area around the electrode from the side the electrode is formed". It is unclear what Applicant means by "a small area around the electrode", the claim is considered indefinite since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2-7 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over Khan et.al. (U.S. Patent No. 4,614,961) in view of Nozaki (Japanese Patent No. 61-008979). With regard to Claim 2, as the best the examiner is able to ascertain the claimed invention, Khan teaches a semiconductor light receiving element comprising a light receiving layer comprising a GaN group semiconductor (14) and an electrode (15) formed on one surface of the light receiving layer as a light receiving surface in such a manner that the light can enter the light receiving layer, wherein the light receiving element is a Schottky barrier type light receiving element, in which a light enters a depletion layer formed under the electrode, wherein the depletion layer can be modified to cover a specific area (column 2, lines 26-37), said light receiving layer is a first conductivity type layer (n-type), said electrode formed on said light receiving surface comprises at least a Schottky electrode (metal Schottky barrier).

However, Khan fails to teach a total of boundary lines between areas of the light receiving surface covered with the Schottky electrode and exposed areas, is longer than the length of the outer periphery of the light receiving surface. Nozaki teaches a photoelectric device including a grid-shaped electrode (15) formed through a transparent conducting film (14), the grid-shaped electrode and the transparent conducting film having a total of boundary lines between areas of the transparent conducting film covered with the grid-shaped electrode and exposed areas that is longer than the length of the outer periphery of the light receiving surface. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the

invention, to modify the structure as taught by Khan to include a total of boundary lines between areas of the light receiving surface covered with the Schottky electrode and exposed areas, is longer than the length of the outer periphery of the light receiving surface, as suggested by Nozaki, in order to optimize the area needed to receive light and minimize the outer periphery.

With regard to Claim 3, a further difference the claimed invention and Khan is, the Schottky electrode having a wiring pattern formed by strip conductors in combination. Nozaki teaches a photoelectric device including a grid-shaped electrode (15) formed through a transparent conducting film (14), the grid-shaped electrode having a wiring pattern comprising strip conductors. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Khan to include Schottky electrode having a wiring pattern formed by strip conductors in combination, as suggested by Nozaki, in order to permit light to enter the light receiving layer more efficiently.

With regard to Claim 4, a further difference the claimed invention and Khan is, the thickness of the strip conductors. It would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Khan to include strip conductors with the claimed thickness, so that the thickness allows for strip conductors which permit light to enter the light receiving layer more efficiently.

With regard to Claim 5, a further difference the claimed invention and Khan is, a wiring pattern having a comblike pattern. Nozaki teaches a photoelectric device including a grid-shaped electrode (15) formed through a transparent conducting film (14), the grid-shaped electrode having a wiring pattern comprising strip conductors in a comblike arrangement. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Khan to include a wiring pattern having a comblike pattern, as suggested by Nozaki, in order to provide strip conductors arranged in a way that permits light to enter the light receiving layer more efficiently.

With regard to Claim 6, Khan teaches a light receiving layer (14) that is an uppermost layer of a laminate comprising one or more layer comprising a first conductivity type GaN group semiconductor formed on a crystal substrate (11) and an ohmic electrode (16) formed on the light receiving layer. However, Khan fails to teach an ohmic electrode formed on a layer other than the light receiving layer. Nozaki teaches a substrate having a grid-shaped electrode (15) formed through a transparent conducting film (14) and an ohmic electrode (11) formed on a layer (11) other than the transparent conducting film. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Khan to include an ohmic electrode formed on a layer other than the light receiving layer, as suggested by Nozaki, in order to provide an ohmic electrode with low contact resistance and which facilitates tunnel current flow.

With regard to Claim 7, Khan teaches a crystal substrate (11) that is made from a conductive material and an ohmic electrode (16). However, Khan fails to teach the ohmic electrode formed on the crystal substrate. Nozaki teaches a substrate having a grid-shaped electrode (15) formed through a transparent conducting film (14) and an ohmic electrode (11) formed on a substrate (11) other than the transparent conducting film. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Khan to include an ohmic electrode formed on the crystal substrate, as suggested by Nozaki, in order to provide a substrate with an ohmic electrode with low contact resistance and which facilitates tunnel current flow.

Claims 8, 10 and 11 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over Ohkubo (U.S. Patent No. 5,710,439) in view of Shibata et.al. (U.S. Patent No. 6,121,17). With regard to Claim 8, Ohkubo teaches a semiconductor light receiving element comprising a light receiving layer (5) comprising a GaN group semiconductor and an electrode (14) formed on one surface of the light receiving layer as a light receiving surface in such a manner that the light can enter the light receiving layer, wherein the light receiving element is a photoconductive type light receiving element (column 2, lines 25-31), the light receiving layer is a first conductivity type I layer (I-InGaAsN), and the electrode formed on the light receiving surface is an ohmic electrode of one polarity (positive electrode), wherein an element comprising an ohmic electrode (13) of the other polarity (negative electrode) is formed over a GaAs semiconductor layer (4).

However, Ohkubo fails to teach that the ohmic electrode of the other polarity is formed directly or via a first conductivity type and low resistance GaN group semiconductor layer. Shibata teaches a semiconductor device including a sapphire substrate (1), a GaN layer (3) and an electrode (8B) directly over the GaN layer. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Ohkubo to include a ohmic electrode of the other polarity formed directly or via a first conductivity type and low resistance GaN group semiconductor layer, as clearly suggested by Shibata, since Group III nitride improve ohmic characteristics, adhesive strength and contact resistance between semiconductor layer and an electrode.

With regard to Claim 10, Ohkubo teaches an ohmic electrode (14) of one polarity that is an opaque electrode (Au) and the light receiving surface has an area covered with the electrode and an incident area not covered with the electrode to permit entry of light.

With regard to Claim 11, Ohkubo teaches an ohmic electrode (13) of the other polarity that is formed semiconductor layer (3), an ohmic electrode (13) of the other polarity (negative electrode) is formed over a GaAs semiconductor layer (4), wherein the GaAs semiconductor layer and the light receiving layer (5) are successively formed on a GaAs substrate (1), an upper surface of the GaAs semiconductor layer is partially exposed, and the ohmic electrode of the other polarity is formed on this exposed surface.

However, Ohkubo fails to teach that the ohmic electrode of the other polarity is formed directly or via a first conductivity type and low resistance GaN group semiconductor layer and that the substrate is of a crystal kind. Shibata teaches a semiconductor device including a sapphire substrate (1), a GaN layer (3) and an electrode (8B) directly over the GaN layer. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Ohkubo to include a crystal substrate and an ohmic electrode of the other polarity formed directly or via a first conductivity type and low resistance GaN group semiconductor layer, as clearly suggested by Shibata, since Group III nitride improve ohmic characteristics, adhesive strength and contact resistance between semiconductor layer and an electrode.

Claim 9 is rejected under 35 U.S.C. § 103 (a) as being unpatentable over Ohkubo (U.S. Patent No. 5,710,439) in view of Shibata et.al. (U.S. Patent No. 6,121,17) and further in view of Berger et.al. (U.S. Patent No. 5,777,390). Ohkubo and Shibata, as stated supra, essentially discloses the claimed invention but fails to teach, the ohmic electrode of one polarity being a transparent electrode. Berger teaches a photodiode which can include opaque electrodes (19) or transparent electrodes, as needed, since transparent electrodes can be utilized for negative-biased electrodes and opaques contacts can used for positive-biased electrodes (column 3, lines 50-52). Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Ohkubo and Shibata to include ohmic

electrode of one polarity being a transparent electrode, as suggested by Berger, in order to provide an electrode which enhances speed and conductivity and permits entry of light.

Claim 12 is rejected under 35 U.S.C. § 103 (a) as being unpatentable over Ohkubo (U.S. Patent No. 5,710,439) in view of Shibata et.al. (U.S. Patent No. 6,121,17) and further in view of Nozaki (Japanese Patent No. 61-008979). With regard to Claim 12, Ohkubo and Shibata essentially disclose the claimed invention but fail to show, an ohmic electrode having a comb-like structure. Nozaki teaches a photoelectric device including a grid-shaped electrode (15) formed through a transparent conducting film (14). Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Ohkubo and Shibata to include an ohmic electrode having a comblike pattern, as suggested by Nozaki, in order to provide strip conductors arranged in a way that permits light to enter the light receiving layer more efficiently.

Response to Arguments

3. The examiner will address Applicant's arguments in the same order as they are presented in the amendment. Applicant's arguments with respect to claims 8, 10 and 12 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's arguments with respect to claims 2-7 have been considered but are not deemed persuasive. Applicant argues that "In the detector of Kahn et.al., the light to be detected enters the depletion layer from the side opposite to the side on which a Schotkky electrode used to block the light is formed" and "In comparison, in the light-receiving element of claim 2, the light enters a depletion layer, which is formed under the electrode and extends to cover a small area around the Schottky electrode, from the side the electrode is formed (i.e. from the surface side of the element). First, as pointed out in the body of the rejection, Khan teaches a semiconductor light receiving element comprising a light receiving layer comprising a GaN group semiconductor (14) and an electrode (15) formed on one surface of the light receiving layer as a light receiving surface in such a manner that the light can enter the light receiving layer, wherein the light receiving element is a Schottky barrier type light receiving element, in which a light enters a depletion layer formed under the electrode, wherein the depletion layer can be modified to cover a specific area. It is also noted that the claim language *does not* disclose that the light enters the "surface side" of the light receiving element, rather, the claim merely discloses that "*light enters a depletion layer formed under the electrode, which extends to cover a small area around the electrode from the side the electrode is formed*". Therefore, the claimed structure does not distinguish from that taught by Kahn.

Applicant also argues, regarding the Nozaki reference, that "the size of the window through which light passes and the area of the electrode are important factors in the device of Nozaki

et.al., whereas the length of the periphery is not particularly important". However, this argument is not deemed persuasive, since the structure as taught by Nozaki discloses a photoelectric device including a grid-shaped electrode (15) formed through a transparent conducting film (14), the grid-shaped electrode and the transparent conducting film having a total of boundary lines between areas of the transparent conducting film covered with the grid-shaped electrode and exposed areas that is longer than the length of the outer periphery of the light receiving surface. Therefore, a total of boundary lines between areas of the light receiving surface covered with the Schottky electrode and exposed areas, is longer than the length of the outer periphery of the light receiving surface, is clearly suggested by Nozaki.

Claim 9 is rejected under new grounds of rejection, however, Applicant's arguments regarding the Berger et.al. reference, are addressed. Applicant argues that "the transparent electrode disclosed by Berger et.al. Is for a completely different type of light -receiving element and serves a different purpose than that of the light receiving element of pending claim 9". The examiner notes that Applicant claims "the ohmic electrode of one polarity being a transparent electrode" and that Berger was cited to show transparent electrodes can be utilized for negative-biased electrodes and opaques contacts can used for positive-biased electrodes (column 3, lines 50-52). Therefore, Berger clearly suggests the use of transparent electrode for an ohmic electrode with a specific polarity.

Lastly, claim 12 is also rejected under new grounds of rejection, however, Applicant's arguments regarding the Nozaki reference, are addressed. Applicant merely argues that "Nozaki et.al. Does not tach or suggest the photocondcutive type light-receiving element of the present invention", but does not show how the claimed invention distinguishes from the structure as taught by Nozaki. Therefore, it is noted that the teachings of Ohkubo, Shibata and Nozaki clearly suggest the claimed invention as disclosed on claim 12, as shown in the body of the rejection.

Conclusion

4. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Edgardo Ortiz (Art Unit 2815), whose telephone number is (703) 308-6183 or by fax at (703) 308-7724. In case the Examiner can not be reached through a direct telephone call, you might call Supervisor Eddie Lee at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application should be directed to the Group 2800 receptionist whose telephone number is (703) 308-0956.

EO / AU 2815

12/6/02